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Combination of diabetic Foot Spa and Sauna Bathing Therapy Decreases the Level of Blood Glucose



Nur Ainiyah^{1*}, Erika Martining Wardani¹, Difran Nobel Bistara¹, Yurike Septianingrum¹, Andikawati Fitriarsari¹, Firdaus¹

ABSTRACT

Introduction: There was evidence that diabetic foot spa has a crucial role in regulating blood glucose levels, but the combination of diabetic foot spa and sauna bathing have never been carried out to decrease blood glucose. The aim of this study was to analyze the combination of diabetic foot spa and sauna bathing therapy and its impact on blood glucose levels.

Methods: The data studied were blood glucose levels. This data can be obtained after administering a combination of diabetic foot spa and sauna bathing and afterward. Then this data was analyzed using an independent t test with p value of 0.000 ($p < 0.005$).

Results: This study showed that 60 respondents, mostly 58.3% were aged 45- 60 years, almost half of the respondents (48.3%) had suffered from DM for <1- 5 years, (70%) women, from the independent t test obtained blood glucose p value= 0.000 ($p < 0.05$).

Conclusion: There was a decrease level of blood glucose after the patients receive the diabetic foot spa and sauna bathing therapy.

Keywords: Diabetic foot spa, Sauna bathing therapy, Level blood glucose.

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INTRODUCTION

Blood glucose levels are very important for improving the condition of patients with diabetes mellitus. A comprehensive understanding of several external and internal factors on changes in blood glucose levels is needed for prevent the complication of patients with diabetes mellitus. External factors that affect changes in blood glucose levels include diet, activity, family support, stress, smoking habits.¹ While internal factors are heredity history with diabetes mellitus.² The decrease in blood glucose levels is very important, therefore several studies related to therapy have been carried out.

Several studies on the use of foot spa sauna bathing for blood glucose have been carried out, for example, the stud Shiralkar et al (2018), used the steam sauna bath method to explain changes in blood glucose levels in fasting people, and the study found a decrease in mean scores. Average fasting blood glucose level

is 14%.³ In addition, Apiyu massage was used to explain changes in sensitivity levels and glucose levels, and the study explained that there was a significant difference between measurements before and after massage using the Apiyu device at the average sensitivity level for pre-massage. test and post-test on the right foot (pre-test 9.49, post-test 9.64; p-value = 0.011) and left leg (pre-test 9.55, post-test 9.80; p-value = 0.004), and (b) blood glucose levels (pre-test 271.6, post-test 220.7; p value = 0.001).⁴ The research showed that (2015) used the hot bath method (sauna: 80-1008C; hot tub: at 408C) to explain changes in blood glucose levels and sleep quality and the study explained that the steam sauna bath method was able to lower blood glucose before and after a steam bath. Foot soak method with warm water and foot massage to explain changes in blood glucose levels and sleep quality and the study was able to reduce blood glucose and sleep quality before and after a steam bath.⁵

However, much uncertainty still exists about the effect between foot spa therapy and blood glucose, but Shiralkar's study has a weakness that respondents must fast first, while in Erika's research only focuses on soaking treatments diabetic foot spa. In addition, there are no studies that conduct the combination of diabetic foot spa and sauna bathing therapy on patient's blood glucose levels. Therefore, this study aimed to analyze the combination of diabetic foot spa and sauna bathing therapy and its effect on blood glucose levels.

METHODS

Study Design

The research design used a one group pre-post-test design. The study population were all patients with type 2 diabetes mellitus (T2DM). The independent variable in this study was blood glucose levels, without fasting. Respondents measure their blood glucose levels before and before treatment. This study involved

60 respondents. This research was used purposive sampling technique. The population in this study were those who had inclusion criteria are T2DM patients who did not have complications such as cardiovascular diseases or renal failure.

Data Collection

This study was conducted by measuring random blood glucose levels before the combination treatment of diabetic foot spa and sauna bathing. Diabetic foot exercise was done before the combination of foot spa and sauna bath, then feet are soaked in warm water for 5 minutes followed by foot massage with foot scrub, rinsed, then given foot moisturizer. Diabetic foot SPA is done 3x a week. While sauna bathing therapy is done after a diabetic foot spa. The implementation of Sauna bathing therapy using a portable sauna device that has been connected to a solution containing spices, then the respondent was asked to enter the portable device

for 20 minutes, measuring blood glucose levels using glucometer.

Data Analysis

Data analysis determined combination between diabetic foot spa and sauna bathing therapy on the level of blood glucose with T2DM using a paired t-test. The results are considered significance if the p value <0.01.

RESULTS

Table 1 describes that most respondents are female (63.4%), 45-60 years old (56.7%), do not smoke (65%), do not regularly take medication (53.3%), rarely have an exercise (66.7%), and had a duration of diabetes for above ten years (40%).

DISCUSSION

The results showed that the majority of female respondents were 60%, because the respondents involved in this study were

more women besides that in line with the results of other studies which showed that women are more at risk of suffering from DM due to hormonal factors, namely a decrease in the hormone estrogen which causes menopause, as well as the presence of LDL, triglycerides or body index in women who are overweight, higher than men.⁶ The decrease in the hormone estrogen will also cause an increase in insulin resistance which causes women to be more at risk of developing diabetes. The hormone estrogen is not produced after menopause causes the risk of Diabetes Mellitus. Changes in the body's hormone levels can trigger fluctuations in sugar levels.⁷

The study also found that almost half had diabetes for more than ten years. The longer you have diabetes, the greater the risk.⁸ In addition, most of the respondents are irregular to do activity. The study reported that the factors that affect blood glucose levels are duration, diabetes, and

Table 1. Distribution of respondents by age, gender, duration of diabetes, smoking habit, medication adherence, and exercise.

Characteristics of Respondents	Group				Total	
	Intervention		Control		f	%
	F	%	f	%		
Gender						
Male	12	40	10	33.3	22	36.6
Female	18	60	20	66.7	38	63.4
Age						
< 45 years	14	46.6	12	40	26	43.3
45 - 60 years	16	53.4	18	60	34	56.7
Duration of diabetes						
<1-5 years	10	33.3	12	40	22	36.7
6-10 years	8	26.7	6	20	14	23.3
11-15 years	6	20	6	20	12	20
16-> 20 years	6	20	6	20	12	20
Smoking habit						
Smoke	10	33.3	11	36.7	21	35
Do not smoke	20	66.7	19	63.3	39	65
Medication adherence						
Irregular	20	66.7	22	73.3	32	53.3
Regular	10	33.3	8	26.7	28	46.7
Exercise						
Often	7	23.3	7	23.3	14	23.3
Rarely	20	66.7	20	66.7	40	66.7
Never	3	10	3	10	6	10

Table 2. The results of Ankle Brachial Index and Blood Glucose Levels Before and After Intervention in Individuals with T2DM.

Group	n	Pre-test		Post-test		t	p
		Mean	SD	Mean	SD		
Blood Glucose Levels							
Intervention	30	2.918	96.86	1.472	69.38	5.893	0.000
Control	30	2.630	67.02	2.575	65.06	0.784	0.439

**Figure 1.** Location of the Pancreas Point on the right and left palms.

obesity. Increased blood glucose levels are associated with irregularity in taking antihyperglycemic drugs and on a DM diet.⁹

This study shows differences between the level of blood glucose before and after the combination of sauna bathing and diabetic foot spa. According to the results, it was shown that the decrease in blood glucose levels is greater than before the intervention was given. These results indicate that there is an effect of diabetic foot spa with sauna bathing on blood glucose levels in type 2 DM patients (p value of 0.000).

The decrease in the average blood glucose level is due to the regulation changes of the metabolic rate, mainly depending on the function of the nervous and endocrine systems and the activity of key enzymes in peripheral tissues. Insulin is an endocrine hormone that has main role to regulate glucose homeostasis, particularly by promoting glucose uptake into muscle and adipose tissue. This

hormone regulates protein metabolism in skeletal muscle in two mechanisms: firstly, by increasing the stimulation of the amino acid uptake into skeletal muscle. The other mechanism is skeletal muscle undergoes the anabolic effect of skeletal muscle insulin caused by its inhibitory action on protein degradation. Thus, hyperthermic conditioning can increase muscle growth by increasing insulin sensitivity and decreasing muscle protein catabolism.¹⁰ Steam saunas has its role to increase the blood flow to skeletal muscles, keeping the muscles filled with glucose and oxygen, while removing the by-products of metabolic processes, such as lactic acid.¹¹

The increasing metabolic rate can also occur due to the excitation of the sympathoadrenal system and the increase of body internal temperature obtained from steam sauna bathing. A study conducted to the patients with diabetes mellitus showed that the steam sauna given for 30 minutes a day, 6 days a week for three weeks showed the significant

average blood glucose level lower than before the patients received the treatment. This study specifically revealed the percentages of blood glucose lower than before treatment was more than 10%. In general, the previous study showed that passive heating, such as steam bathing, can enhance the rate at which people burn calories and help reduce blood glucose spikes.¹² In the future, if this procedure is well-maintained, it can help the patients to control their weight and improve their blood glucose control.⁷

According to Faulkner, there is a slightly decreased amount of blood glucose after bathing compared with exercise. It also showed that heat shock protein (HSP) was produced and released when body temperature increases. The protein was one of the defense system and it helps transport the glucose from bloodstream into the skeletal muscle, so there will be lower levels of blood glucose. The increasing level of blood level will be occur when the body is in the stress conditions. The body will have certain events with stress conditions, such as inflammation, infection, or exercise. Faulkner stated that the increasing of body temperature through hot baths and saunas are beneficial if the body could maintain insulin resistance and control blood sugar, or in certain condition, the patients are unable to exercise physically.^{5,13}

Thus, repetitive passive heating may have a role to reduce the chronic inflammation, such as type II diabetes.¹³ A previous study stated that the effect infrared saunas has beneficial effect on cardiovascular in T2DM. The study was conducted on 15 patients with infrared sessions three times a week for a period of 3 months. This study found that the mean systolic blood pressure (SBP) was 6.4 mmHg. There is a decreased waist circumference by 5.1 cm.¹⁴ While in

Shirkalkar's (2018) study, which conducted 80 subjects with seven steam sauna baths with duration of 15 minutes. The previous study found that there was a significant decrease in FBGL after seven steam baths.³ Therefore, steam saunas can be considered one of the non-pharmacological therapeutic interventions in the lifestyle modification of T2DM patients.

Foot spa was one of a foot care that can be given to diabetic patients in order to prevent any foot complications-caused-by-diabetes, such as gangrene wounds and diabetic feet. The main principle of diabetic foot prevention was to avoid any injury and the needs to control of blood sugar. In diabetic foot spas, foot gymnastics, skin cleansing, pedicure or nail trimming are aim to prevent the nails for becoming too long and might injured the feet. The massage was important in this procedure when it can be applied in certain points that connect the pancreas to stimulate the production of insulin. This procedure is popular due to its beneficial aspects in blood circulation. It also provides relaxing effect to the patients.¹⁵ The massage was carried out on the pancreatic nerve points, namely on the soles of the right and left feet, in longitudinal zone 1 and transverse zone 3 (Figure 1).

The pancreas gland was produced by massage in this point, so the hormones insulin and glucagon, will keep balance blood sugar levels.¹⁶ This study same with Suyanto, that showed better-increased foot sensation after combining diabetic foot exercise and spa than diabetic foot exercises only.¹⁷ Diabetic foot exercise improves foot sensation, so it reduces the risk of injury in individuals with Type 2 Diabetes Mellitus (T2DM). In addition, a diabetic foot spa helps peripheral blood circulation for them. Combining diabetic foot spa and exercise has a good impact on the blood glucose levels.

CONCLUSION

In conclusion, the combination diabetic foot spa and sauna bathing therapy might decrease the level blood glucose levels, so it can be prevented complications. Further research would to prove for other effect related with this treatment for T2DM.

DISCLOSURE

Author Contribution

All authors have contributed to this research process, including conception and design, analysis and interpretation of the data, drafting of the article, critical revision of the article for important intellectual content, final approval of the article, collection and assembly of data.

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The authors are responsible for all of the study funding without a grant or any external funding source.

Conflict of Interest

There is no conflict of interest for this manuscript.

Ethical Consideration

This research was approved by the Health Research Ethics Committee of the Nahdlatul Ulama Surabaya. Letter of exemption Ref. No. 272/KEPK/UNUSA/2020.

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